FXO, FXS, and E&M Voice Interface Card Support on Cisco 1700 Series Routers

This document describes the support on the Cisco 1751 and Cisco 1760 routers for the following new voice interface cards (VICs):

- VIC2-2FXO, the 2-port Foreign Exchange Office (FXO) VIC, including CAMA functionality
- VIC2-4FXO, the 4-port FXO VIC, including CAMA functionality
- VIC2-2FXS, the 2-port Foreign Exchange Station (FXS) VIC
- VIC2-2E/M, the 2-port recEive and transMit (E&M) VIC

This document contains the following sections:

VIC2-2FXS, VIC2-2FXO, and VIC2-4FXO

An FXS interface connects directly to a standard telephone, fax machine, PBX, or similar device, and supplies ring, voltage, and dial tone to the station.

An FXO interface connects local calls to a public switched telephone network (PSTN) central office or to a PBX that does not support E&M signaling. This is the interface a standard telephone provides.

To configure the ports on the 2-port VIC2-2FXS VIC, the 2-port VIC2-2FXO VIC and the 4-port VIC2-4FXO VIC, refer to the "Configure FXS or FXO Voice Ports" section in the *Cisco 1751 Router Software Configuration Guide*.

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Note   On these new VICs (the VIC2-2FXS, VIC2-2FXO, and VIC2-4FXO), the ports are configured separately.

CISCO SYSTEMS

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Restrictions on VIC2-4FXO Usage

When configured for operation in countries that use the TBR21 mode, the use of VIC2-4FXO cards is subject to the following limitations.

- In the Cisco 1751 router, a maximum of one VIC2-4FXO card can be supported.
- In the Cisco 1760 router, a maximum of two VIC2-4FXO cards can be supported.

When not operating in the TBR21 mode, these limitations do not apply.

These restrictions do not apply to VIC2-2FXO cards.

CAMA Functionality on VIC2-2FXO and VIC2-4FXO

The 2-port VIC2-2FXO VIC and the 4-port VIC2-4FXO VIC have the capabilty to operate in the Centralized Automated Message Accounting (CAMA) mode of operation.

Software Requirements

CAMA functionality on VIC2-2FXO and VIC2-4FXO VICs in Cisco 1751 and Cisco 1760 routers requires Cisco IOS Release 12.3(2)XA or later.

Overview of CAMA

CAMA is a signaling protocol that was originally designed for toll call billing purposes but has been adapted to carry a single telephone number for Enhanced 911 (E911) purposes. E911 is an emergency telephone system capable of automatically displaying the callback number (and in some cases the location) of a person who dials 911 to request emergency help from public safety agencies.

The North American emergency E911 phone system consists of a voice network that is built largely outside of the normal PSTN on which common voice traffic rides. Calls to emergency services are treated specially because they are routed differently from normal traffic within the PSTN. Calls to emergency services are routed on the basis of the calling number, not the called number. The calling number is checked against a database of emergency service providers that cross-references the service providers for the caller's particular location. When this information is determined, the call is then routed to the proper public service answering point (PSAP), which dispatches services to the caller's location.

During setup of a call to E911, before the audio channel is connected, the calling number is transmitted to each switching point, known as a Selective Router (SR), via CAMA. CAMA is used because it carries both the calling and called number using in-band signaling.This allows the telephone system to send a station identification number to the PSAP through the telephone company's E911 equipment. CAMA trunks are used in 80 percent of the E911 network today.

The calling number is needed at the PSAP for two reasons:

- To use the calling number to reference an Automatic Location Identification (ALI) database to find the caller's exact location and any extra information about the caller that may have been stored in the database
- To reconnect to the callback number in case the call is disconnected

Figure 1 shows the topography in existing E911 networks. Figure 2 shows an E911 network using the VIC2-2FXO or VIC2-4FXO card, configured for CAMA, in a Cisco 1751 or Cisco 1760 router.

Figure 1   Existing E911 Networks
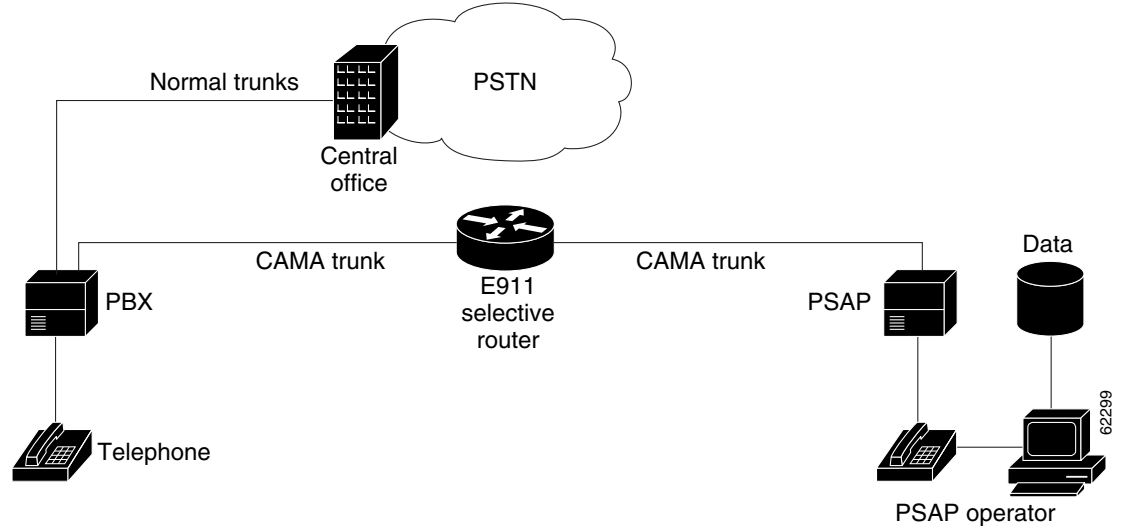
Figure 2   Analog CAMA E911 Networks
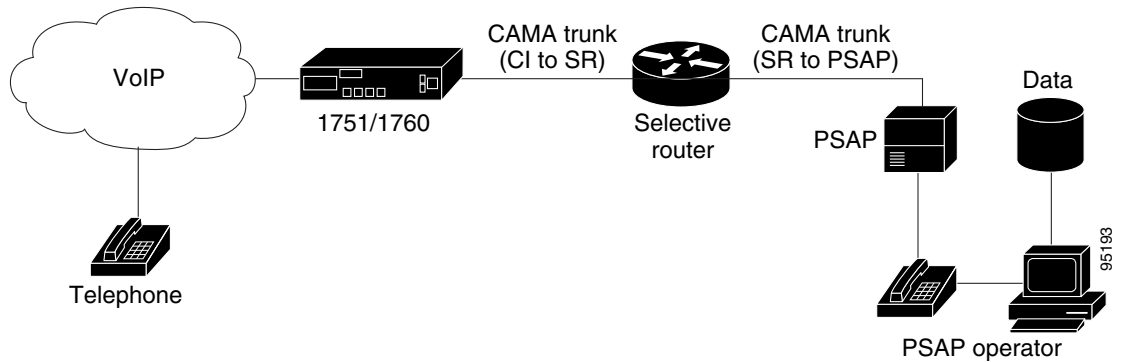
Configuring CAMA

To configure a VIC2-2FXO or VIC2-4FXO card to recognize CAMA signaling, perform the following steps in global configuration mode.

Note   When a port on these VICs is not configured for CAMA signaling, the port will function as a normal FXO port, and all existing FXO functionality will be available.

	Command	Purpose
Step 1	`Router(config)# ` **`voice-port`** *`slot/port`*	Identifies the voice port to be configured.
Step 2	`Router(config-voiceport)# ` **`signal`** `{`**`cama`** `{`**`KP-0-NPA-NXX-XXXX-ST`** `|` **`KP-0-NXX-XXXX-ST`** `|` **`KP-2-ST`** `|` **`KP-NPD-NXX-XXXX-ST`**`}` `|` **`groundstart`** `|` **`loopstart`**`}}`	Selects the desired signal and specifies the type of CAMA signaling. The following are the four CAMA signaling options for transmitting the calling number: • Type 1 — **KP-0-NXX-XXXX-ST** • Type 2 — **KP-0-NPA-NXX-XXXX-ST** • Type 3 — **KP-2-ST** • Type 4 — **KP-NPD-NXX-XXXX-ST** The card default, without CAMA enabled, is loopstart.
Step 3	`Router(config-voiceport)# ` **`shut`**	Disables the selected port on the voice interface card.
Step 4	`Router(config-voiceport)# ` **`no shut`**	Enables CAMA signaling. **Note** You must perform the **shut** and **no shut** commands in steps 3 and 4 to complete the activation of CAMA on the voice ports being configured.

The CAMA signaling options are as follows:

- **KP-0-NXX-XXXX-ST**—7-digit Automatic Number Identification (ANI) transmission. The Numbering Plan Area (NPA) or area code is implied by the trunk group and is not transmitted.

- **KP-0-NPA-NXX-XXXX-ST**—10-digit transmission. The E.164 number is fully transmitted.

- **KP-2-ST**—Default transmission when the CAMA trunk cannot obtain a corresponding Numbering Plan Digit (NPD) in the look-up table, or when the calling number is fewer than 10 digits. (NPA digits are not available.)

- **KP-NPD-NXX-XXXX-ST**—8-digit ANI transmission, in which the NPD is a single multifrequency (MF) digit that is expanded into the NPA. The NPD table is preprogrammed by configuring ANI mapping in the sending and receiving equipment (on each end of the MF trunk); for example: 0= 408, 1=510, 2=650, 3=415. See Configuring ANI Mapping, below.

  NPD values range from 0 through 3. Examples of telephone numbers in this signaling option are:

  – 05550123 = (408) 555-0123

  – 25550199 = (650) 555-0199

  ✎

  Note If the NPD value does not match a value in the NPD table, the CAMA signaling option defaults to **KP-2-ST**.

Configuring ANI Mapping

To configure a VIC2-2FXO or VIC2-4FXO card for 8-digit ANI transmission, perform the following steps in global configuration mode.

	Command	Purpose
Step 1	`Router(config)# **voice-port** slot/port`	Identifies the voice port that you want to configure and enters voice-port configuration mode.
Step 2	`Router(config-voiceport)# **ani mapping** NPD-value NPA-number`	Builds the table that translates the Numbering Plan Area (NPA), or area code, into a single MF digit. The number of Numbering Plan Digits (NPDs) programmed is determined by local policy and by the number of NPAs or area codes that the PSAP serves.
		The NPD value range is 0-3.
		The NPA number range is 100-999.
		Note Repeat Step 4 until all NPAs (area codes) are configured or until the NPD range maximum is reached.

Configuration and Verification

The following example shows the configuration of the VIC2-2FXO card for 8-digit transmission. In this example, ANI mapping is shown for the following area codes (NPAs): 0=408, 1=510, 2=650, 3=415.

```
voice-port 0/0
 ani mapping 0 408
 ani mapping 1 510
 ani mapping 2 650
 ani mapping 3 415
 signal cama KP-NPD-NXX-XXXX-ST
 shut
 no shut
```

Configuration may be verified by use of the **show run** command, or the **show voice port** command, or the **show voice port summary** command.

```
router # show run
...
!
voice-port 0/0
 ani mapping 0 408
 ani mapping 1 510
 ani mapping 2 650
 ani mapping 3 415
 signal cama KP-NPD-NXX-XXXX-ST
!
...
end
```

The following example shows the result of a **show voice port summary** command on a router with a VIC2-2FXO card in slot 0. Port 0 is configured for CAMA, and port 1 is configured for normal FXO operation.

```
router# show voice port summary
------------------------------------------------------
PORT      CH   SIG-TYPE    ADMIN OPER STATUS   STATUS   EC
========  ==   ==========  ===== ==== ======== ======== ==
0/0       --   fxo-cama    up    up   idle     on-hook  y
0/1       --   fxo-ls      up    up   idle     on-hook  y
```

VIC2-2E/M

An E&M interface connects remote calls from an IP network to PBX trunk lines (tie lines) for local distribution.

To configure the ports on the 2-port VIC2-2E/M VIC, refer to the "Configure E&M Voice Ports section" in the *Cisco 1751 Router Software Configuration Guide*.

Note   On all E&M VICs, including the VIC2-2E/M VIC, the ports cannot be configured separately.

Related Documentation

For information on installing FXO, FXS, and E&M VICs in Cisco 1700 series routers, refer to the following:

- *Cisco Interface Cards Hardware Installation Guide*

For additional information about installing and configuring the Cisco 1751 and Cisco 1760 routers, go to the Cisco 1700 series routers website

http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/1700/index.htm

and refer to the following documentation:

- *Cisco 1751 Router Hardware Installation Guide*
- *Cisco 1751 Router Software Configuration Guide*
- *Cisco 1760 Modular Access Router Hardware Installation Guide*
- *Quick Start Guide for Installing Your Cisco 1760 Modular Access Router*

Obtaining Documentation

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Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

http://www.cisco.com/univercd/home/home.htm

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http://www.cisco.com

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http://www.cisco.com

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The avenue of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Cisco TAC Website

You can use the Cisco TAC website to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC website, go to this URL:

http://www.cisco.com/tac

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

http://tools.cisco.com/RPF/register/register.do

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

http://www.cisco.com/en/US/support/index.html

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC website so that you can describe the situation in your own words and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

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  http://www.ciscopress.com

- *Packet* magazine is the Cisco monthly periodical that provides industry professionals with the latest information about the field of networking. You can access *Packet* magazine at this URL:

  http://www.cisco.com/en/US/about/ac123/ac114/about_cisco_packet_magazine.html

- *iQ Magazine* is the Cisco monthly periodical that provides business leaders and decision makers with the latest information about the networking industry. You can access *iQ Magazine* at this URL:

  http://business.cisco.com/prod/tree.taf%3fasset_id=44699&public_view=true&kbns=1.html

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in the design, development, and operation of public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

  http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training, with current offerings in network training listed at this URL:

  http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html

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